

CLAIMS

1. A battery package comprising:

a group of batteries having a plurality of connected secondary batteries,
each forming a unit battery;

5 a plurality of sensors for detecting a temperature and a voltage;

a display device for displaying a condition of the group of batteries;

a switch for controlling charge and discharge of the group of batteries; and

an operational control circuit for generating a signal based on signals input
from the plurality of sensors to make the display device display the condition of

10 the group of batteries, and to activate the switch,

wherein the battery package is further provided with a refreshing demand
display device for displaying a need to initiate a refreshing charge and discharge
if a recovery voltage of the secondary batteries does not exceed a predetermined
voltage after a lapse of a predetermined time from a moment when the
15 secondary batteries come to a final discharge voltage.

2. A battery package comprising:

a group of batteries having a plurality of connected secondary batteries,
each forming a unit battery;

20 a plurality of sensors for detecting a temperature and a voltage;

a display device for displaying a condition of the group of batteries;

a switch for controlling charge and discharge of the group of batteries; and

an operational control circuit for generating a signal based on signals input
from the plurality of sensors to make the display device display the condition of

25 the group of batteries, and to activate the switch,

wherein the operational control circuit is provided with a non-detecting
timer for preventing the sensors from detecting the voltage during a

predetermined time period from beginning of the charge,

the operational control circuit counts a number of times that the voltage of the batteries exceeds a preset voltage within the predetermined time period, and

further wherein the battery package is provided with a refreshing demand display device for displaying a need to initiate a refreshing charge and discharge
5 when the counted number reaches a predetermined number.

3. A battery package comprising:

a group of batteries having a plurality of connected secondary batteries,
10 each forming a unit battery;

a plurality of sensors for detecting a temperature and a voltage;

a display device for displaying a condition of the group of batteries;

a switch for controlling charge and discharge of the group of batteries; and

an operational control circuit for generating a signal based on signals input
15 from the plurality of sensors to make the display device display the condition of the group of batteries, and to activate the switch,

wherein the operational control circuit is provided with a non-detecting timer for preventing the sensors from detecting the voltage during a predetermined time period from beginning of the charge,

20 the operational control circuit counts a number of times that the voltage of the batteries exceeds a preset voltage within the predetermined time period, and

further wherein the battery package is provided with a refreshing demand display device for displaying a need to initiate a refreshing charge and discharge in any of events that the counted number reaches a predetermined number, and
25 a recovery voltage of the batteries does not exceed a predetermined voltage after another predetermined time has elapsed from a moment when the batteries come to a final discharge voltage.

4. The battery package according to one of claim 1 and claim 3, wherein the refreshing demand display device displays a need to initiate the refreshing charge and discharge if the recovery voltage of the secondary batteries does not
5 exceed 1.15 volt after one day or longer time has elapsed from the moment when the batteries come to the final discharge voltage.

5. The battery package according to one of claim 1 to claim 4, wherein each of the secondary batteries comprises an alkaline storage battery provided with a
10 positive electrode mainly composed of a nickel oxide, a negative electrode, a separator, and an alkaline electrolyte.

6. The battery package according to claim 5, wherein the negative
15 electrode comprises a hydrogen storage alloy.

7. The battery package according to one of claim 1 to claim 3, wherein the temperature sensor for detecting temperature detects a temperature of the secondary batteries, and the operational control circuit computes a rate of temperature change according to the detected temperature, and generates and
20 delivers a signal for terminating the charge to the switch for controlling the charge and discharge of the group of batteries, when the rate of temperature change exceeds a preset range.

8. A method of charging and discharging a battery in a battery package,
25 the battery package comprising:

a group of batteries having a plurality of connected secondary batteries, each forming a unit battery;

a plurality of sensors for detecting a temperature and a voltage;
 a display device for displaying a condition of the group of batteries;
 a switch for controlling charge and discharge of the group of batteries; and
 an operational control circuit for generating a signal based on signals input
 5 from the plurality of sensors to make the display device display the condition of
 the group of batteries, and to activate the switch, and
 the method comprising the step of carrying out a refreshing charge and
 discharge if a recovery voltage of the secondary batteries does not exceed a
 predetermined voltage after a predetermined time has elapsed from a moment
 10 when the batteries come to a final discharge voltage.

9. A method of charging and discharging a battery in a battery package,
 the battery package comprising:
 a group of batteries having a plurality of connected secondary batteries,
 15 each forming a unit battery;
 a plurality of sensors for detecting a temperature and a voltage;
 a display device for displaying a condition of the group of batteries;
 a switch for controlling charge and discharge of the group of batteries; and
 an operational control circuit for generating a signal based on signals input
 20 from the plurality of sensors to make the display device display the condition of
 the group of batteries, and to activate the switch, and
 the method comprising the steps of:
 preventing the sensors from detecting the voltage by means of a
 non-detecting timer provided in the operational control circuit;
 25 counting a number of times in which the voltage of the batteries exceeds a
 preset voltage within a predetermined time period by means of the operational
 control circuit; and

carrying out a refreshing charge and discharge when the counted number reaches a predetermined number.

10. A method of charging and discharging a battery in a battery package,
5 the battery package comprising:

a group of batteries having a plurality of connected secondary batteries,
each forming a unit battery;

a plurality of sensors for detecting a temperature and a voltage;

a display device for displaying a condition of the group of batteries;

10 a switch for controlling charge and discharge of the group of batteries; and
an operational control circuit for generating a signal based on signals input
from the plurality of sensors to make the display device display the condition of
the group of batteries, and to activate the switch, and

the method comprising the steps of:

15 preventing the sensors from detecting the voltage by means of a
non-detecting timer provided in the operational control circuit;

counting a number of times in which the voltage of the batteries exceeds a
preset voltage within a predetermined time period by means of the operational
control circuit; and

20 carrying out a refreshing charge and discharge in any of events that the
counted number reaches a predetermined number, and a recovery voltage of the
batteries does not exceed a predetermined voltage after another predetermined
time has elapsed from a moment when the batteries come to a final discharge
voltage.

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11. The method of charging and discharging a battery according to one of
claim 8 and claim 10, comprising the step of carrying out the refreshing charge

and discharge if the recovery voltage of the secondary batteries does not exceed 1.15 volt after one day or longer time has elapsed from a moment when the batteries come to the final discharge voltage.

5 12. The method of charging and discharging a battery according to one of claim 8 to claim 11, further comprising the steps of charging the battery up to 90 to 120% of an initial capacity with a current of $5.0 \cdot I_t$ or less, and further charging up to 150 to 200% with a current of $2.0 \cdot I_t$ or less for a given duration controlled by the timer function provided in the operational control circuit
10 during the refreshing charge and discharge, where " I_t " denotes a rated battery capacity.

 13. The method of charging and discharging a battery according to one of claim 8 to claim 11, further comprising the steps of detecting a temperature of
15 the secondary batteries with the sensor, computing a rate of temperature change according to the detected temperature by means of the operational control circuit, and delivering a signal for termination of the charge to the switch for controlling the charge and discharge of the group of batteries when the rate of temperature change exceeds a preset range.

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 14. The method of charging and discharging a battery according to claim 13, wherein the rate of temperature change is preset to a range of 0.5 and 4.0 °C/min.

25 15. The method of charging and discharging a battery according to claim 14, wherein the rate of temperature change is preset to a range of 1.0 and 3.0 °C/min.

16. The method of charging and discharging a battery according to one of claim 8 to claim 11, comprising the step of carrying out charge and discharge by any of a constant-current charging and discharging method, a constant-voltage charging and discharging method, and a combination of the constant-current charging and discharging method and the constant-voltage charging and discharging method.